



**Establishment and Operation of a Regional System of Fisheries Refugia in the
South China Sea and the Gulf of Thailand**

REPORT

**STRUCTURE POPULATION AND MATURITY OF BANANA SHRIMP
(*Penaeus merguensis* and *Penaeus indicus*)
IN WEST KALIMANTAN PROVINCE**

**SOUTHEAST ASIAN FISHERIES DEVELOPMENT CENTER
TRAINING DEPARTMENT**

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(*Penaeus merguensis* and *Penaeus indicus*)
IN WEST KALIMANTAN PROVINCE**

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1. Background

The waters of West Kalimantan are part of the South China Sea (SCS) which has a relatively shallow depth on the coast, becomes the estuary for large and small rivers, and we can still find mangrove areas in several locations. This area is a potential habitat for penaeid shrimp (shrimp from the Penaeidea family). The catching efforts with various types of active and passive fishing gear show that the exploitation rate of shrimp is highly exploited or even over-exploited because shrimp has high economic value. The demand for these commodities at the world market level continues to increase (Sumiono & Widodo, 2003).

The decline in shrimp production in West Kalimantan is not only caused by habitat degradation but is also affected by fishing activities that are not environmentally friendly which can reduce the shrimp stocks. One of the efforts to manage sustainable shrimp fisheries is to establish the fisheries refugia concept. According to UNEP (2006), this concept is based on a zoning approach in fisheries management through habitat improvement and efforts to minimize the effect of fishing on economically important fish/shrimp stocks in critical areas. Thus, the fisheries refugia concept is related to the sustainability of the fish/shrimp stocks in certain areas, which is focused on the relationship between the life cycle of fish/shrimp and critical habitats in the nursery ground and fishing ground.

Previously, during 2013-2015, Research Institute for Fish Enhancement has studied the nursery area of Penaeid Shrimp in West Kalimantan Province. The spawning area information of Penaeid shrimp is still needed to complete the fisheries refugia concept for shrimp in West Kalimantan. Therefore, this study aims to identify the shrimp species caught by fishermen on the coast of West Kalimantan and assess the biological aspects of economically significant shrimp of *Penaeus* spp.

2. Methods

2.1. Time and study area

The survey of shrimp data collection was carried out for eight days from 11 to 18 October 2021, covering several villages in Batu Ampar District and Pulau Maya District located in two coastal regencies of West Kalimantan Province: North Kayong District and Kubu Raya District.

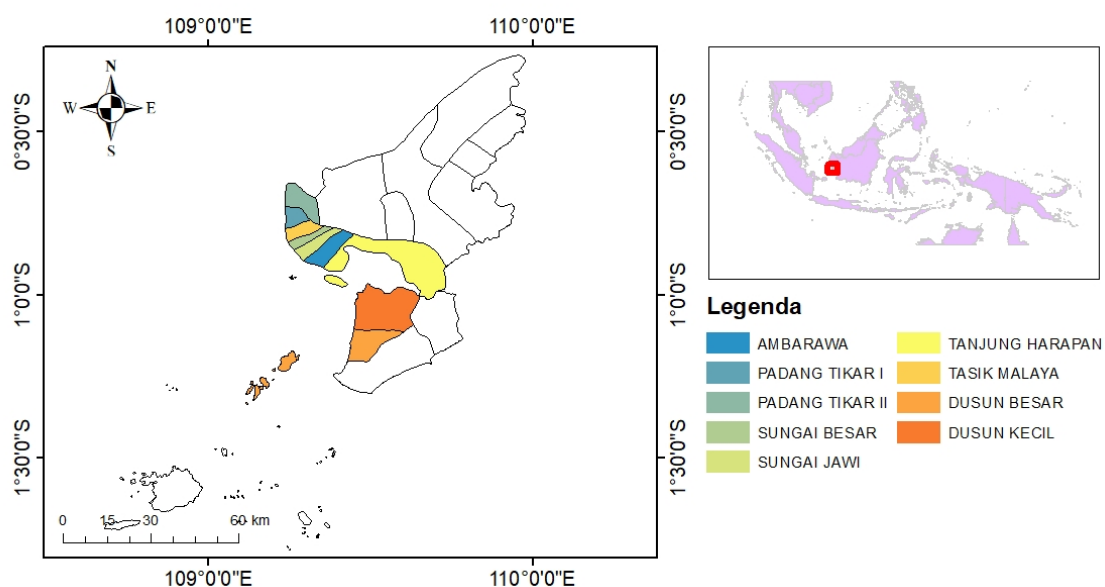


Figure 1 Villages in Batu Ampar District and Pulau Maya District (the coloured parts) as survey locations of the shrimp resource on the coast of West Kalimantan Province

2.2. Data Collection

Data collection on shrimp resources on the coast of West Kalimantan was conducted using a survey method based on direct observation and experimental fishing by various fishing gears that can represent the spatial distribution of the adult shrimp. The fishing gear used in this study included trawls and trammel nets. In addition, shrimp samples were also obtained from fisherfolk at landing sites. Shrimp samples obtained from landing sites represent 5 locations: Padang Tikar 2 village, Sungai Besar village, Ambarawa village, Tasik Malaya village, and Dusun Besar village.

The shrimp species caught by fisherfolk and experimental fishing were identified using Chan (1998), especially from the North Kayong Regency area, which in 2015 was not the research area of RIFE. The sex of shrimps was observed by looking at the presence of male (petasma) and female (telycum) genital organs (Figure 2). Carapace length (cm) and body weight (g) of shrimps were measured.

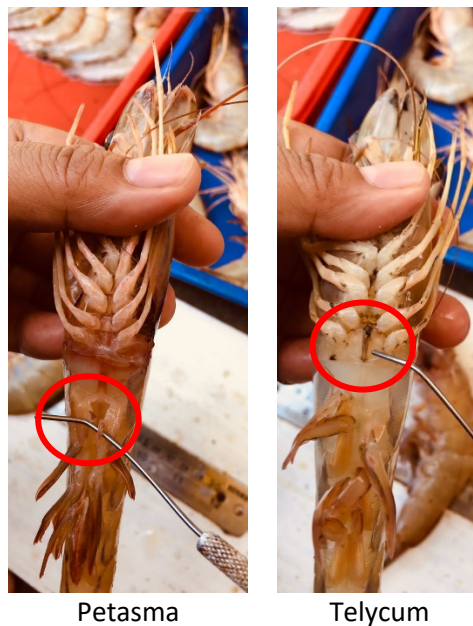


Figure 2 Genital organs of male and female *Penaeus merguensis* and *Penaeus indicus*.

2.3. Data Analysis

The population structure of both *Penaeus* sp. (*Penaeus indicus* and *Penaeus merguensis*) were tabulated with Microsoft Excel with a difference between classes of carapace length of 2 mm. The gonad maturity level of female shrimp was also observed, with stages I and II of gonad maturity categorized as immature and stage III – V classified as mature shrimp. We also analysed both species' length at first maturity (Lm) and the length at first capture (Lc).

3. Result

3.1. Shrimp species

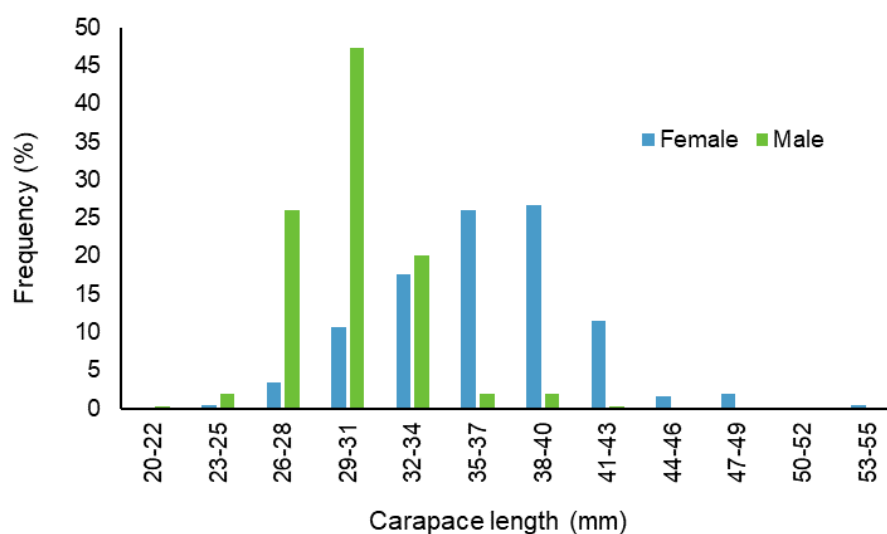
A total of 1846 shrimp samples were observed in this study consisting of 18 species of shrimp, including *Exopalaemon* sp., *Penaeus merguensis*, *P. indicus*, *Metapenaeopsis toloensis*, *Metapenaeus affinis*, *M. brevicornis*, *M. dobsoni*, *M. ensis*, *M. lysianassa*, *M. tenuipes*, *Parapenaeopsis cornuta*, *P. coromandelica*, *P. hardwickii*, *P. hungerfordi*, *P. maxillipedo*, *P. sculptilis*, and *Trachypenaeus granulosus*. Two economically important shrimp species found on the coast of West Kalimantan waters are *Penaeus merguensis* and *Penaeus indicus* (Figure 3).

*Penaeus merguensis**Penaeus indicus*

Figure 3 Two important shrimp species on the coast of West Kalimantan Waters

3.2. The population structure of *Penaeus* spp.

The population structure of *Penaeus merguensis* shrimp is shown in Figure 4. The total number of *Penaeus merguensis* shrimp caught was 664, dominated by male shrimp (57%). The length of the male shrimp ranged from 20 - 41 cm and weighed between 6.86 - 45.19 grams, while the female shrimp had a length of 23-54 cm and weighed between 8.57 - 88.71 grams. Male shrimp dominated the carapace length class 29-31 mm, while female shrimp dominated the 38-40 cm carapace length class.

Figure 4 Carapace length class (mm) of *Penaeus merguensis* shrimp

107 *Penaeus indicus* shrimp were observed at the study site, dominated by male shrimp (57%). The male shrimp caught had a carapace length between 17-35 cm and weight 5.45-38.55 grams, while the female shrimp caught had a carapace length size 23-40 m and a weight 6.87 - 36.45 grams. Male shrimp in 29-31 mm carapace length class dominated with 47.3%, while female shrimp dominated in class 38-40 mm with a percentage of 26.7%. Figure 5 shows the carapace length class frequency of *Penaeus indicus* shrimp caught at the study site.

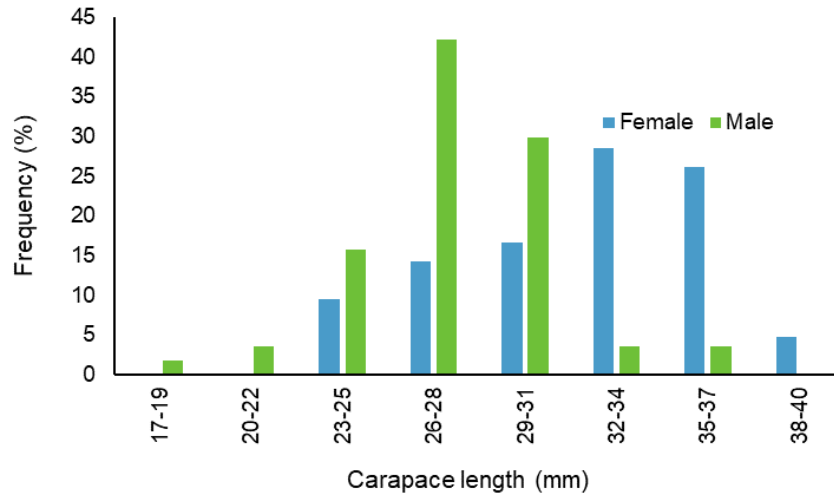


Figure 5 The carapace length class (mm) of *Penaeus indicus* shrimp

3.3. Gonad maturity stages of *Penaeus merguensis* and *P. indicus*.

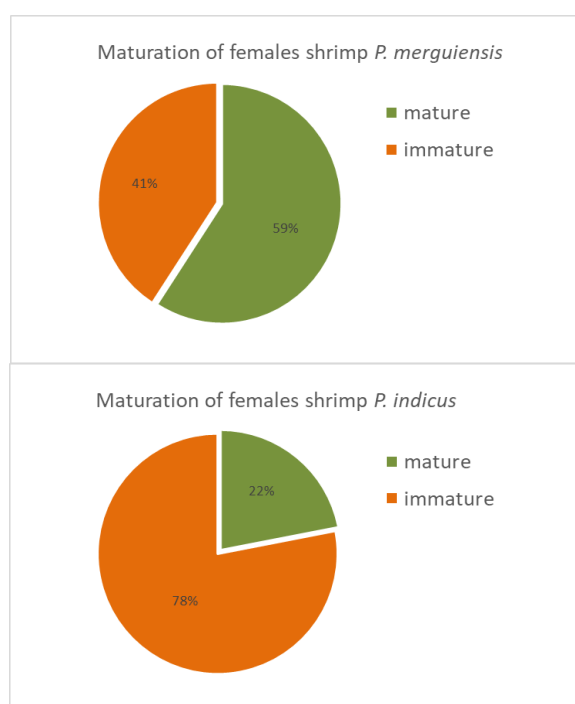
During the study, the team observed gonadal maturity (stage I-V) of female shrimp *P. merguensis* and *P. indicus*, divided into immature female and mature female shrimp (Figure 6). The survey results revealed that the presence of 262 mature female *P. merguensis* shrimps (59%) more than the immature shrimp (41%), whereas the mature female *P. indicus* (32 fish, 22%) were less compared to mature females (78%) from a total of 41 samples. Figure 7 shows the percentage of immature and mature female shrimp from both species of *Penaeus*.



Immature



Mature

Figure 6 Gonad maturity of *Penaeus merguensis*Figure 7 The percentage of mature and immature females of *P. merguensis* and *P. indicus*

3.4. Carapace length at first capture (Lc) and carapace length at first maturity

The different carapace length at first capture (Lc) values between males and females shrimp occurred from Lc analysis for both species *Penaeus* shrimp, where the Lc of females was higher than the males shrimp. The carapace length at first capture (Lc) of *Penaeus merguensis* males shrimp was 29.27 mm, while the Lc of females' shrimp was 35.34 mm. Overall, the Lc from *Penaeus merguensis* was 32.85 mm. Figure 8 shows a graph of the estimated Lc of the male *Penaeus merguensis* shrimp (a) and the female (b).

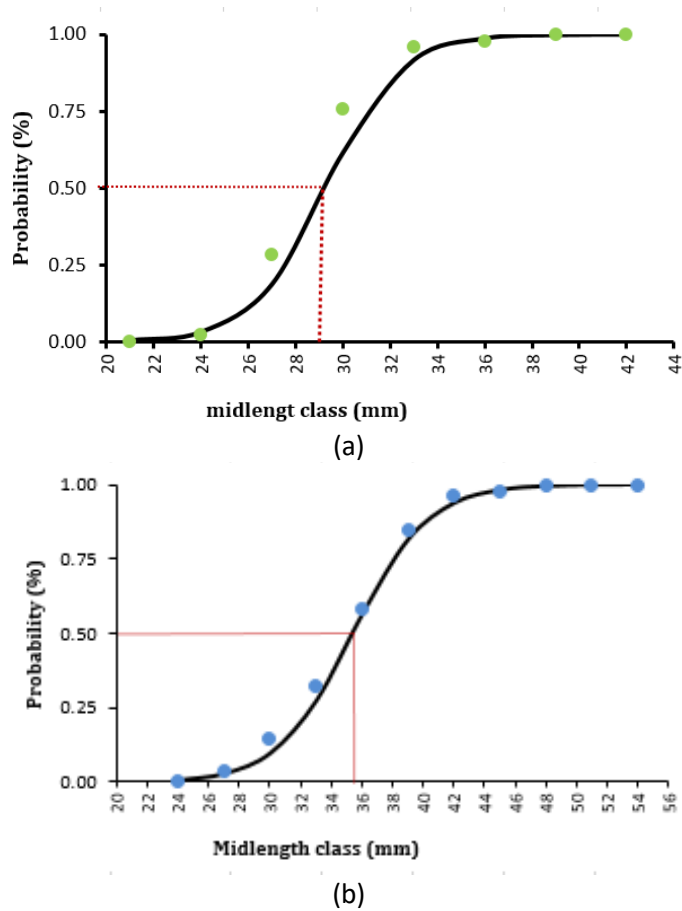
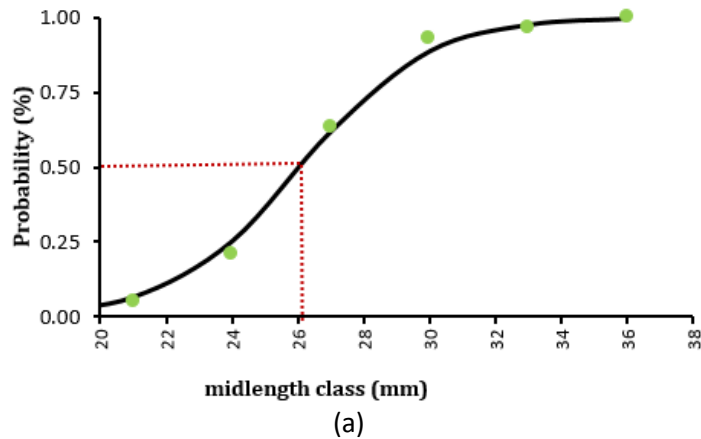
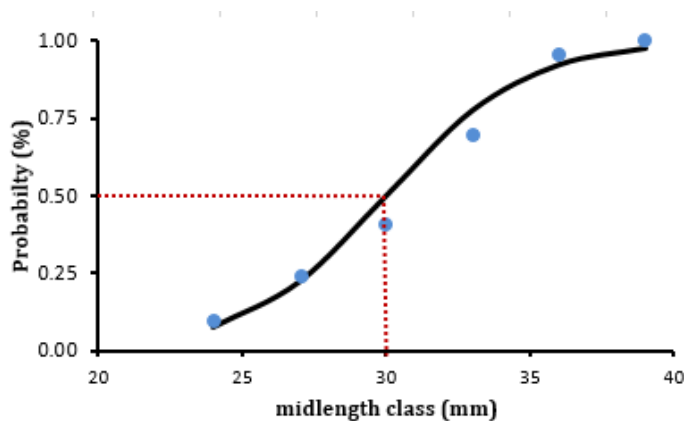


Figure 8 Length at first capture of (a) males and (b) females *Penaeus merguensis*

The Lc value of males *Penaeus indicus* shrimp (26.07 mm) was smaller than of females' shrimp (30 mm), where overall, the Lc caught from *Penaeus indicus* shrimp was 32.85 cm. The graphs for Lc of males and females *Penaeus indicus* shrimp are shown in Figures 9 a and b.





(b)

Figure 9 Length at first capture of (a) males and (b) females *Penaeus indicus*

The carapace length at first maturity (Lm) of the females *P. merguensis* was 34.9 mm (Lm) and 34.2 mm for *P. indicus*. Comparison of Lc and Lm values of *P. merguensis* shrimp showed a higher Lc value than Lm (Lc = 35.34 mm, Lm = 34.9 mm), while for *P. indicus* shrimp the value of Lc smaller than Lm (Lc = 30 mm, Lm = 34.2 mm). **A good fishing condition is when the value of Lc higher than Lm indicates that the shrimp caught are big or primarily mature.**

3.5. Shrimp catches by fishing gear

Table 1 shows the catch of *Penaeus merguensis* and *P. indicus* shrimp based on four fishing gear. *Penaeus indicus* was caught more by mini trawl, while *P. merguensis* was caught more by trammel net loading (Table 1). Referring to the Lm female shrimp at first maturity *P. merguensis* (34.9 mm), most of *P. merguensis* shrimps caught with the trammel net were adult shrimp (149 individuals). Meanwhile more *P. indicus* caught were in the immature stage (26 individuals), with the Lm value of *P. indicus* = 34.2 mm (Table 2).

Table 1 The shrimp catches by fishing gears

Carapace length (mm)	<i>Penaeus indicus</i>			
	Trap net	Mini trawl	Trammel	Trammel net (loading)
<23	1	1	1	
23-25	1	9	3	
26-28	5	20	5	
29-31	2	16	3	3
32-34	4	8	1	1
34-36	1	5	1	4
37-39		1		1
40-42	1	1		
Total	15	61	14	9
<i>Penaeus merguensis</i>				
	Trap net	Mini trawl	Trammel	Trammel net (loading)
<23			1	
23-25			3	5
26-28	1	4	10	85
29-31	4	12	5	173
32-34	4	7		107
34-36	1	6		38
37-39	5	7		76

40-42	1	1		45
43-45	1			6
46-48				5
>48				4
Total	17	37	19	544

Table 2 The males and females (immature and mature) of two shrimp species

Shrimp species-Sex	The number of shrimp catches			
	Trap net	Mini trawl	Trammel	Trammel (loading) net
<i>Penaeus indicus</i>				
Immature females	5	26		2
Mature females	3	3		3
Males	7	32	14	4
<i>Penaeus merguensis</i>				
Immature females	2	16	2	87
Mature females	4	2		149
Males	11	15	17	306

4. Involved persons

- Mrs. Adriani Sri Nastiti, Researcher of Research Institute for Fish Resource Enhancement
- Mrs. Sri Endah Purnamaningtyas, Researcher of Research Institute for Fish Resource Enhancement
- Mrs. Masayu Rahmia Anwar Putri, Researcher of Research Institute for Fish Resource Enhancement
- Mrs. Astri Suryandari, Researcher of Research Institute for Fish Resource Enhancement
- Mrs. Dian Oktaviani, Researcher of Centre for Fisheries Research
- Mr. Arip Rahman, Researcher of Research Institute for Fish Resource Enhancement
- Mr. Yusuf Nugraha, Technician of Research Institute for Fish Resource Enhancement
- Mr. Dedi Sumarno, Technician of Research Institute for Fish Resource Enhancement
- Mr. Sukamto, Technician of Research Institute for Fish Resource Enhancement

5. Activities documentation
5.1. Shrimp sample collection



Shrimp fishing with minitrawl



Shrimp fishing with trammel loading



The catches of trammel loading



The catches of minitrawl

5.2. shrimp sample measurement



Measurement of carapace length (mm)



Measurement of shrimp weight (gram)